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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/020,030	10/30/2001	Steven Duane Myers	1483	8958

21396 7590 06/14/2007

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EXAMINER	
NGUYEN BA, HOANG VU A	
ART UNIT	PAPER NUMBER
2623	

MAIL DATE	DELIVERY MODE
06/14/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Advisory Action Before the Filing of an Appeal Brief	**Application No.** 10/020,030	**Applicant(s)** MYERS, STEVEN DUANE	
	Examiner Hoang-Vu A. Nguyen-Ba	**Art Unit** 2623	

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 21 May 2007 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

1. ☒ The reply was filed after a final rejection, but prior to or on the same day as filing a Notice of Appeal. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114. The reply must be filed within one of the following time periods:
   a) ☐ The period for reply expires _____months from the mailing date of the final rejection.
   b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.

   Examiner Note: If box 1 is checked, check either box (a) or (b). ONLY CHECK BOX (b) WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☐ The proposed amendment(s) filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   (a) ☐ They raise new issues that would require further consideration and/or search (see NOTE below);
   (b) ☐ They raise the issue of new matter (see NOTE below);
   (c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   (d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: _____. (See 37 CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☒ For purposes of appeal, the proposed amendment(s): a) ☐ will not be entered, or b) ☒ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.
   The status of the claim(s) is (or will be) as follows:
   Claim(s) allowed: _____.
   Claim(s) objected to: _____.
   Claim(s) rejected: 32-47.
   Claim(s) withdrawn from consideration: _____.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ The affidavit or other evidence filed after a final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
9. ☐ The affidavit or other evidence filed after the date of filing a Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing a good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
10. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

11. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: See attached note.
12. ☐ Note the attached Information Disclosure Statement(s). (PTO/SB/08) Paper No(s). _____
13. ☐ Other: _____.

Hoang-Vu Antony Nguyen-Ba
Primary Examiner
Art Unit: 2623

1. This is responsive to the amendment after final filed May 21, 2007.

Response to Arguments

2. **New Matter Objections and Rejections under 35 U.S.C. § 112**

Applicant's arguments with respect to Claims 33, 41, 36, 44, 37 and 45:

Claims 33, 41, 36, 44, 37, and 45 are objected to and rejected for the phrase "a second subscriber unit". However, the specification teaches a second subscriber unit in that *multiple subscribers* (page 2, line 17) and *a plurality of subscribers sites* (page, line 20; page 8, line 21) are described. The accompanying description of FIG. 3 indicates that subscriber unit 300 is illustrative of the type of subscriber unit that is provided at *each* subscriber unit site (page 9, line 23). The second subscriber unit is another, or second, subscriber unit of the multiple subscribers or plurality of subscribers sites. For the aforementioned reasons, claims 33, 41, 36, 44, 37, and 45 are allowable.

Examiner's response:

The examiner agrees with Applicant that Applicant's specification does teach multiple subscribers and a plurality of subscribers. However, Applicant's specification does not teach "a second subscriber unit" which is configured to receive **the** second CDMA signal which is recited in Claim 1 to be the result of the multicast signal processed by a second code to generate a second CDMA signal. Alternatively stated, the second subscriber unit as claimed is daisy-chained to the first subscriber unit. The second subscriber unit is not construed to be another subscriber unit that is configured in parallel with the first subscriber unit where it also receives another first unicast signal, another first multicast signal, processes the unicast signal to generate another first CDMA signal, processes the multicast signal to generate another second CDMA

signal to be received by another second subscriber unit, etc. Applicant's specification is interpreted to **imply** a plurality of units that are similar to the claimed first unit in Claim 1, **not** a second unit that is similar to the claimed *second destination unit* recited in dependent Claim 35.

Therefore, the objection of these claims under 35 U.S.C. 132 (a) because the amendment introduces new matter into the disclosure and the added material is not adequately supported by the original disclosure and the rejection of these claims under 35 U.S.C. § 112, first paragraph as failing to comply with the written description requirement are maintained.

The objection and rejection of Claims 34, 35, 36, & 37 and 42, 43, 44 & 45, which depend from Claims 33 and 41 respectively are also maintained for the same reasons.

3. **Objection to the Drawings**

Applicant submitted at p. 8 of the Remarks (3rd paragraph) that the applicant is required to *furnish drawings where necessary for the understanding of the subject matter to be patented* (37 CFR § 1.81(a)) and that additional drawings that literally show multiple subscriber units are not necessary to the understanding of the claimed invention and rather, the [filed] drawings and specification together clearly provide for a sufficient understanding of the claimed subject matter.

In response the examiner respectfully notes that without a written description of a second subscriber unit that is configured to receive the second CDMA signal in the specification and without an illustration of the so-claimed invention in any of the submitted drawings, the subject

matter of the invention claimed in Claims 33-37 and 41-45 is not clearly understood.

Therefore, the objection to the drawings is maintained.

4. **35 U.S.C. § 102(b) Rejection**

Applicant's arguments:

The final Office action equates the data traffic received by base station B with the *unicast signal* recited in claims 32 and 40. The final Office action also equates the video traffic received by base station B with the *multicast signal* recited in Claims 32 and 40. However, Agrawal does not specify whether either the data traffic to the video traffic is unicast or multicast traffic. While Agrawal does disclose that bae station B is capable of transmitting in a unicast/multicast phase (Agrawal, col. 10, lines 32-34), Agrawal does not distinguish what type of traffic is received by base station B. Such an assertion is based on improper hindsight reasoning.

Examiner's response:

The examiner respectfully notes the following sections in the MPEP, § 2131:

"[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or **inherently** described, in a single prior art reference." (emphasis added). *Verdegaal Bros.* v. *Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

... The elements must be arranged as required by the claim, but this is not an *ipsissimis verbis* test, i.e., identity of terminology is **not** required. (emphasis added). *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed. Cir. 1990).

Since each and every claimed elements are found inherently described although not identically named by Agrawal, Applicant's claim is considered anticipated and the rejection is maintained.

Applicant's arguments:

Agrawal does not discloses that the two signals transmitted simultaneously are received by a single one of the mobile stations X and Y.

Examiner's response:

The Office action cites at least FIG. 1 as showing Station Y receiving the two signals, e.g., the bottom two input lines to device Y. Thus, contrary to Applicant's assertion Agrawal does anticipate the above features.

Applicant's arguments:

Agrawal does not disclose a subscriber unit that receives two different CDMA signals generated using two CDMA codes and transmitted simultaneously.

Examiner's response:

In response, the examiner respectfully notes that the same response as discussed above is considered to adequately address Applicant's concerns.

With respect to claims 33 and 41:

In response to Applicant's assertion that Agrawal does not disclose that one of the mobile stations X or Y receives both the first and second signal, and that the other mobile stations X or Y receives the second signal, the examiner respectfully submits the same response as discussed above which also adequately addresses applicant's argument that Agrawal teaches away from the claimed requirements.

With respect to claims 34 and 42:

Applicant submits that in Agrawal the new traffic to be sent from the mobile station to a destination device is not the traffic received by the mobile from base B and that in addition the new traffic is modulated

before being sent to base station B – not demodulated as required by claims 34 and 42. Applicant further asserts that the modulated traffic is not multiplexed onto a local network by the mobile station.

In response to these arguments, the examiner respectfully directs applicant's attention to FIG. 1 where it shows that the traffic received by mobile station Y (e.g., the bottom two inputs to Y) is demodulated by mobile station Y and sent to subscribers (not back to Station B as asserted by Applicant). Furthermore, these signals are multiplexed by the mobile station Y before being sent to subscribers.

Accordingly, the rejection of claims 32-47 under 35 U.S.C. § 102(b) as being anticipated by Agrawal is maintained.

Hoangan Antony Nguyen-Ba

ANTONY NGUYEN-BA
PRIMARY EXAMINER
TECHNOLOGY CENTER 2100

OK for entry
Jan 6/12/07

REPLY UNDER 37 CFR 1.116
EXPEDITED PROCEDURE
TECHNOLOGY CENTER 2600

Practitioner's Docket No. 1483 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Steven Duane Myers Confirmation No.: 8958

Application No.: 10/020,030 Group No.: 2623

Filed: October 30, 2001 Examiner: Nguyen BA, Hoang Vu A

For: MULTI-POINT MULTI-CHANNEL DATA DISTRIBUTION SYSTEM

Mail Stop: AF
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

RESPONSE

In response to the final Office action of March 22, 2007, please consider the following remarks. As this response is being submitted within two months of the date of the final Office action, the Applicant respectfully contends that the extension of time policy set forth in 37 C.F.R. § 1.136(a) and MPEP § 714.13 pertaining to responses to final rejections applies to this response.

REPLY UNDER 37 CFR 1.116
EXPEDITED PROCEDURE
TECHNOLOGY CENTER 2600

Practitioner's Docket No. 1483 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Steven Duane Myers Confirmation No.: 8958

Application No.: 10/020,030 Group No.: 2623

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RESPONSE

In response to the final Office action of March 22, 2007, please consider the following remarks. As this response is being submitted within two months of the date of the final Office action, the Applicant respectfully contends that the extension of time policy set forth in 37 C.F.R. § 1.136(a) and MPEP § 714.13 pertaining to responses to final rejections applies to this response.

REMARKS

Claims 32-47 are pending in the application. Claims 32-47 stand rejected. The applicant respectfully requests consideration of the following remarks and allowance of the claims.

New Matter Objections and 35 U.S.C. § 112 Rejections

Claims 33-37 and 41-45 are objected to as adding new matter. Claims 33-37 and 41-45 also stand rejected under 35 U.S.C. § 112 , first paragraph, as failing to comply with the written description requirement. The applicant contends that no new matter has been added and that the claimed subject matter is adequately described in the specification. Rather, the specification of the present application contains ample support for all the aspects of claims 33-37 and 41-45. The objections and rejections should be withdrawn accordingly.

Claims 33, 41, 36, 44, 37, and 45 are objected to and rejected for the phrase "a second subscriber unit". However, the specification teaches a second subscriber unit in that *multiple subscribers* (page 2, line 17) and *a plurality of subscriber sites* (page 5, line 20; page 8, line 21) are described. The accompanying description of FIG. 3 indicates that subscriber unit 300 is illustrative of the type of subscriber unit that is provided at *each* subscriber site (page 9, line 23). The second subscriber unit is another, or second, subscriber unit of the multiple subscribers or plurality of subscriber sites. For the aforementioned reasons, claims 33, 41, 36, 44, 37, and 45 are allowable.

Claims 34, 42, 35, 43, 36, 44, 37, and 45 are objected to and rejected for the phrase to "multiplex the first local demodulated signal onto a first local network for delivery to a first destination device". However, the specification teaches in several instances multiplexing a first local demodulated signal onto a first local network for delivery to a first destination device. In a first instance, the specification discloses subscriber site equipment 112-119 that demodulates two RF channels simultaneously and then *multiplexes the two demodulated channels onto a single Ethernet interface* (page 6, lines 11-12). In another instance, the specification discloses a subscriber unit 300 that *multiplexes received data from both downstream channels onto a local subscriber network* is disclosed (page 10, lines 12-13). In yet another instance, the specification

discloses demodulators 322A and 322B that demodulate a received signal into a unicast signal 101U and a multicast signal 101M and *multiplex the digital signals onto an Ethernet link 325* (page 11, lines 21-23). For the aforementioned reasons, claims 34, 42, 35, 43, 36, 44, 37, and 45 are allowable.

Claims 37 and 45 are objected to and rejected for the phrase "second unicast signal". However, the specification clearly teaches a "second unicast signal". The specification discloses a transmission headend facility 110 that transmits *multiple* channels of video, audio, or other data in *unicast* mode to *multiple subscribers* via a segmented frequency band (page 5, lines 23-26). The second unicast signal is another one, or second, of the multiple channels of video, audio or other data transmitted in unicast mode to multiple subscribers. For the aforementioned reasons, claims 37, and 45 are allowable.

Claims 36 and 44 are objected to and rejected for the phrase "third local demodulated signal". However, as discussed above the specification teaches multiple subscriber units, multiple unicast signals, and a multicast signal. The third local demodulated signal referred to in claims 36 and 44 is the multiplex signal demodulated by another one of the second subscriber units into another, or third, local demodulated signal and multiplexed onto one of the local networks.

Claims 36 and 44 are further objected to and rejected for the phrase "second local network". However, as discussed above the specification discloses multiple *subscriber sites* (page 5, line 20; page 8, line 21). Each subscriber site has a local network (page 10, line 13). The second local network referred to in claims 36 and 44 is another, or second, local network at another local subscriber site.

Claims 36 and 44 are further objected to and rejected for the phrase "third destination device". However, as discussed above the specification discloses multiple subscriber sites. Each subscriber site has a local network. Multiple devices are connected to the local network (page 2, line 23). The third destination device referred to in claims 36 and 44 is another one, or third, of the devices on one of the local networks.

Claims 36 and 44 are further objected to and rejected for the phrase "multiplexing the third local demodulated signal into a second local network for delivery to a third destination device". However, as discussed above the specification clearly teaches

multiplexing local demodulated signals onto a local network. The specification also teaches multiple subscriber units and multiple local networks. As further discussed above, the third local demodulated signal is another, or third, local demodulated signal, and the second local network is another, or second, local network. Another one of the subscriber units multiplexes the third local demodulated signal onto second local network. For the aforementioned reasons, claims 36, and 44 are allowable.

Objections to the Drawings

The drawings are objected to under 37 C.F.R. § 1.83(a) as not showing every feature of the invention as specified in the claims. In particular, the final Office action objects that the drawings do not show a second subscriber unit, a multiplexer, a second unicast signal, a third local demodulated signal, a second local network, and a third destination device. The applicant requests that the objection be withdrawn.

The applicant is required to *furnish drawings where necessary for the understanding of the subject matter to be patented* (37 C.F.R. § 1.81(a)). Additional drawings that literally show multiple subscriber units are not necessary to the understanding of the claimed invention. Rather, the drawings and specification together clearly provide for a sufficient understanding of the claimed subject matter.

For example, FIG. 1 illustrates a subscriber site 120, while FIG. 3 illustrates a subscriber unit 300. The accompanying description of FIG. 1 indicates that multiple subscriber sites are contemplated (page 5, line 20). In addition, the accompanying description of FIG. 3 indicates that subscriber unit 300 is illustrative of the type of subscriber unit that is provided at *each* subscriber site (page 9, line 23). The second subscriber unit referred to in the claims is another subscriber unit provided at another subscriber site. The illustration of subscriber unit 300 therefore adequately provides for the necessary understanding of the second subscriber unit as claimed. Regardless, multiple subscriber sites 120 (A1, A2, B1, B2, C1, and C2 in FIG. 7) are shown in the drawings.

The applicant notes that, contrary to the assertion in the final Office action, a multiplexer is not claimed. Rather, the first and second subscriber units are described in the claims as performing a multiplexing function. A multiplexer per se is not claimed.

35 U.S.C. § 102(b) Rejection

Claims 32-47 stand rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 6,072,784 (Argrawl). The applicant respectfully disagrees for at least the following reasons. The examiner is kindly requested to reconsider the rejection.

Independent claims 32 and 40 describe a network transceiver processing a first unicast signal using a first code to generate a first CDMA signal. The network transceiver also processes a multicast signal using a second code to generate a second CDMA signal. The network transceiver then *simultaneously* transmits the first CDMA signal and the second CDMA signal. A first subscriber unit receives both the first CDMA signal and the second CDMA signal. Argrawl fails to disclose all of the limitations of claims 32 and 40. Claims 32 and 40 are therefore allowable.

The final Office action equates the data traffic received by base station B with the *unicast signal* recited in claims 32 and 40. The final Office action also equates the video traffic received by base station B with the *multicast signal* recited in claims 32 and 40. However, Argrawl does not specify whether either the data traffic or the video traffic is unicast or multicast traffic. While Argrawl does disclose that base station B is capable of transmitting in a unicast/multicast phase (Argrawl, col. 10, lines 32-34), Argrawl does not distinguish what type of traffic is received by base station B. Such an assertion is based on improper hindsight reasoning. MPEP 2141 [illegible] 35 USC 103; The Graham Factual Inquiries

In addition, the final Office action equates the base station B transmitting two CDMA signals to mobile stations X and Y with *simultaneously transmitting the first CDMA signal and the second CDMA signal* as recited in claims 32 and 40. Next, the final Office action equates either mobile station X or Y receiving the two signals with the *first subscriber unit receiving the first CDMA signal and the second CDMA signal.* Such a characterization of Argrawl is incorrect. In Argrawl, the base station B transmits one of two CDMA signals to mobile station X. Simultaneously, the base station B transmits the other of two CDMA signals to mobile station Y. However, Argrawl does not disclose that the two signals transmitted simultaneously are received by a single one of the mobile stations X and Y.

Further in claims 32 and 40, two codes are recited to generate the first and second CDMA signals. The first subscriber unit then receives both the first and the second CDMA signals. In contrast, Argrawl discloses that each CDMA code can be allocated to exactly one mobile unit per time slot (Argrawl, col. 9, lines 41-45). Thus, Argrawl does not disclose a subscriber unit that receives two different CDMA signals generated using two CDMA codes and transmitted simultaneously.

For the aforementioned reasons, claims 32 and 40 are allowable over Argrawl.

In claims 33 and 41, the final Office action equates either mobile station X or Y receiving the two signals transmitted by base station B with *receiving the second CDMA signal in a second subscriber unit*. However, claims 33 and 41 require the second CDMA signal, transmitted simultaneously with the first CDMA signal, to be received by both the first subscriber unit and the second subscriber unit. Argrawl only discloses multiple signals transmitted by base station B to mobile stations X and Y. Argrawl does not disclose that one of the mobile stations X or Y receives both the first and second signal, and that the other mobile station also receives the second signal. Argrawl actually teaches away from such a requirement by disclosing that each CDMA code can only be allocated to *exactly* one mobile unit per time slot (Argrawl, col. 9, lines 41-45).

For the aforementioned reasons, claims 33 and 41 are allowable over Argrawl.

In claims 34 and 42, the final Office action equates the mobile station X or Y communicating with other communication devices or computers via base station B with *demodulating the first CDMA signal into a first local demodulated signal and multiplexing the first local demodulated signal onto a first local network for delivery to a first destination device.* As described in claims 34 and 42, the first local demodulated signal is related to the first CDMA signal and is itself multiplexed onto the first local network. In contrast, Argrawl discloses the mobile station modulating new traffic destined for another device so as to transmit the new traffic to base station B. The new traffic to be sent from the mobile station to a destination device is not the traffic received by the mobile station from base station B. In addition, the new traffic is modulated before being sent to base station B- not demodulated as required by claims 34 and 42. Furthermore, the modulated traffic is not multiplexed onto a local network by the mobile

station. Rather, the mobile station transmits the modulated traffic to base station B, which is not a local network.

For the aforementioned reasons, claims 34 and 42 are allowable over Argrawl. The remaining dependent claims, while separately allowable, depend from otherwise allowable independent claims. The applicant therefore refrains from a discussion of the remaining dependent claims for the sake of brevity.

CONCLUSION

Based on the above remarks, the Applicant submits that claims 32-47 are allowable. Additional reasons in support of patentability exist, but such reasons are omitted in the interests of clarity and brevity. The Applicant thus respectfully requests allowance of claims 32-47.

The Applicant believes no fees are due with respect to this filing. However, should the Office determine fees are necessary, the Office is hereby authorized to charge Deposit Account No. 21-0765.

Respectfully submitted,

/Stephen S. Roche/

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In the Claims

1 – 31. (Cancelled)

32. (Original) A wireless communication system comprising:

a network transceiver configured to:

receive a first unicast signal;

receive a multicast signal;

process the first unicast signal using a first code to generate a first code division multiple access (CDMA) signal;

process the multicast signal using a second code to generate a second CDMA signal; and

simultaneously transmit the first CDMA signal and the second CDMA signal; and

a first subscriber unit configured to receive the first CDMA signal and the second CDMA signal.

33. (Original) The wireless communication system of claim 32 further comprising:

a second subscriber unit configured to receive the second CDMA signal.

34. (Original) The wireless communication system of claim 33 wherein the first subscriber unit is configured to demodulate the first CDMA signal into a first local demodulated signal and multiplex the first local demodulated signal onto a first local network for delivery to a first destination device.

35. (Original) The wireless communication system of claim 34 wherein the first subscriber unit is configured to demodulate the second CDMA signal into a second local demodulated signal and multiplex the second local demodulated signal onto the first local network for delivery to a second destination device.

36. (Original) The wireless communication system of claim 35 wherein the second subscriber unit is configured to demodulate the second CDMA signal into a third local demodulated signal and multiplex the third local demodulated signal onto a second local network for delivery to a third destination device.

37. (Original) The wireless communication system of claim 36 wherein:

the network transceiver is further configured to receive a second unicast signal, process the second unicast signal using a third code to generate a third CDMA signal, and transmit the third CDMA signal; and

the second subscriber unit is configured to receive the third CDMA signal, demodulate the third CDMA signal into a fourth local demodulated signal and multiplex the fourth local demodulated signal onto the second local network for delivery to a fourth destination device.

38. (Original) The wireless communication system of claim 32 wherein the multicast signal comprises video.

39. (Original) The wireless communication system of claim 38 wherein the first unicast signal comprises data.

40. (Original) A method of wireless communication, the method comprising:

in a network transceiver:

receiving a first unicast signal;

receiving a multicast signal;

processing the first unicast signal using a first code to generate a first code division multiple access (CDMA) signal;

processing the multicast signal using a second code to generate a second CDMA signal;

simultaneously transmitting the first CDMA signal and the second CDMA signal; and

in a first subscriber unit:

receiving the first CDMA signal and the second CDMA signal.

41. (Original) The method of claim 40 further comprising:

receiving the second CDMA signal in a second subscriber unit.

42. (Original) The method of claim 41 further comprising:

in the first subscriber unit:

demodulating the first CDMA signal into a first local demodulated signal; and

multiplexing the first local demodulated signal onto a first local network for delivery to a first destination device.

43. (Original) The method of claim 42 further comprising:

in the first subscriber unit:

demodulating the second CDMA signal into a second local demodulated signal; and

multiplexing the second local demodulated signal onto the first local network for delivery to a second destination device.

44. (Original) The method of claim 43 further comprising:

in the second subscriber unit:

demodulating the second CDMA signal into a third local demodulated signal; and

multiplexing the third local demodulated signal onto a second local network for delivery to a third destination device.

45. (Original) The method of claim 44 further comprising:

in the network transceiver:

receiving a second unicast signal;

processing the second unicast signal using a third code to generate a third CDMA signal;

transmitting the third CDMA signal; and

in the second subscriber unit:

receiving the third CDMA signal;

demodulating the third CDMA signal into a fourth local demodulated signal; and

multiplexing the fourth local demodulated signal onto the second local network for delivery to a fourth destination device.

46. (Original) The method of claim 40 wherein the multicast signal comprises video.

47. (Original) The method of claim 46 wherein the first unicast signal comprises data.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/020,030	10/30/2001	Steven Duane Myers	1483	8958

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SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/22/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/020,030	MYERS, STEVEN DUANE	
	Examiner	Art Unit	
	Hoang-Vu A. Nguyen-Ba	2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 November 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *32-47* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *32-47* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 October 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This action is responsive to the amendment filed November 20, 2006.

2. Claims 32-47 are pending. Claims 32 and 40 are independent claims.

Response to Arguments

3. Per Applicant's request, Claims 1-31 have been cancelled and new Claims 32-47 have been added.

4. The amendment filed November 20, 2006 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows:

a. the "second subscriber unit" claimed in Claims 33, 41, 36, 44, 37, 45;

b. the **multiplexer** (e.g., to "multiplex the first local demodulated signal onto a first local network for delivery to a first destination device" in Claim 34) in Claims 34, 42, 35, 43, 36, 44, 37, 45;

c. the "second unicast signal" claimed in Claims 37, 45;

d. the "third local demodulated signal" claimed in Claims 36, 44;

e. the "second local network" claimed in Claims 36, 44;

f. the "third destination device: claimed in Claims 36, 44; and

g. the multiplexer that multiplexes the third local demodulated signal onto the second local network claimed in Claims 36, 44.

Applicant is required to cancel the new matter in the reply to this Office Action.

Response to Arguments

5. Applicant's arguments with respect to claims 1-31 have been considered but are moot in view of the new ground(s) of rejection necessitated by Applicant's cancellation of Claims 1-31 and introduction of new claims that have different scope(s) than those of the canceled claims.

Drawings

6. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the following features:

a. the "second subscriber unit" claimed in Claims 33, 41, 36, 44, 37, 45;

b. the **multiplexer** (e.g., to "multiplex the first local demodulated signal onto a first local network for delivery to a first destination device" in Claim 34) in Claims 34, 42, 35, 43, 36, 44, 37, 45;

c. the "second unicast signal" claimed in Claims 37, 45;

c. the "second unicast signal" claimed in Claims 37, 45;

d. the "third local demodulated signal" claimed in Claims 36, 44;

e. the "second local network" claimed in Claims 36, 44;

f. the "third destination device: claimed in Claims 36, 44; and

g. the multiplexer that multiplexes the third local demodulated signal onto the second local network claimed in Claims 36, 44

must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the

immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

7. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

8. Claims 33, 41, 34, 42, 35, 43, 36, 44, 37, 45 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The following features:

a. the "second subscriber unit" claimed in Claims 33, 41, 36, 44, 37, 45;

b. the **multiplexer** (e.g., to "multiplex the first local demodulated signal onto a first local network for delivery to a first destination device" in Claim 34) in Claims 34, 42, 35, 43, 36, 44, 37, 45;

c. the "second unicast signal" claimed in Claims 37, 45 do not appear to be described in the specification;

d. the "third local demodulated signal" claimed in Claims 36, 44;

e. the "second local network" claimed in Claims 36, 44;

f. the "third destination device: claimed in Claims 36, 44; and

g. the multiplexer that multiplexes the third local demodulated signal onto the second local network claimed in Claims 36, 44

do not appear to be described in the specification.

Claim Rejections – 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejection under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 32-47 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,072,784 to Agrawal et al. ("Agrawal").

Claim 40

Agrawal discloses:

in a network transceiver (see at least FIG. 1, B Station; it is noted that although shown separate from the Base Station, the transceiver 314 is actually part of the Base Station, as disclosed at 7:9-12)*:*

receiving a first unicast signal (see at least 7:56 - 8:7; the claimed *unicast* signal being equated with data message)*;*

receiving a multicast signal (see at least 7:56 - 8:7; the claimed *multicast* signal being equated with video message)*;*

processing the first unicast signal using a first code to generate a first code division multiple access (CDMA) signal (see at least FIG. 1 which shows that the network is a CDMA wireless network with inherent processors to process/generate CDMA signals; see also background information on CDMA at 8:66 – 9:45)*;*

processing the multicast signal using a second code to generate a second CDMA signal (see at least FIG. 1 which shows that the network is a CDMA wireless network with inherent processors to process/generate CDMA signals; see also background information on CDMA at 8:66 – 9:45)*;*

simultaneously transmitting the first CDMA signal and the second CDMA signal (see at least FIG. 1 showing the B Station transmitting the two signals to stations X and Y; see also background information on CDMA at 8:66 – 9:45)*; and*

in a first subscriber unit (see at least FIG. 1, either Station X or Y):

receiving the first CDMA signal and the second CDMA signal (see at least FIG. 1, either Station X or Y receiving the two signals; see also background information on CDMA at 8:66 – 9:45).

Claim 32

Since Claim 32 is a wireless communication system version of Claim 40, the same rejection is deemed applicable to Claim 32.

Claims 41 and 33

Agrawal further discloses *receiving the second CDMA signal in a second subscriber unit* (see at least FIG. 1, either Station X or Y receiving the two signals).

Claims 42 and 34

Agrawal further discloses *in the first subscriber unit* (see at least FIG. 7)*:*

demodulating the first CDMA signal into a first local demodulated signal (see at least FIG. 7, the signal incoming traffic to the first VC Queue on the left)*; and*

multiplexing the first local demodulated signal onto a first local network for delivery to a first destination device (see at least FIG. 7, the incoming traffic to VC Queue on the left being multiplexed with the out signal from the Application on the left to become the outgoing traffic to the mobile transmitter to be transmitted to a destination device, e.g., the base station).

Claims 43 and 35

Agawal further discloses *in the first subscriber unit* (see at least FIG. 7):

demodulating the second CDMA signal into a second local demodulated signal (see at least FIG. 7, the incoming traffic signal to the VC Queue in the center)*; and*

multiplexing the second local demodulated signal onto the first local network for delivery to a first destination device (see at least FIG. 7, the incoming traffic to VC

Queue in the center being multiplexed with the out signal from the Application in the center to become the outgoing traffic to the mobile transmitter to be transmitted to a destination device, e.g., the base station).

Claims 44 and 36

Agawal further discloses *in the second subscriber unit* (see at least FIG. 7):

demodulating the second CDMA signal into a third local demodulated signal (see at least FIG. 7, the signal incoming traffic to the VC Queue on the right)*; and*

multiplexing the third local demodulated signal onto a second local network for delivery to a third destination device (see at least FIG. 7, the incoming traffic to VC Queue in the right being multiplexed with the out signal from the Application in the right to become the outgoing traffic to the mobile transmitter to be transmitted to a destination device, e.g., the base station).

Claims 45 and 37

Agawal further discloses:

in the network transceiver (see at least FIG. 1, Base Station B)*:*

receiving a second unicast signal (see at least FIG. 1, Base Station B receiving a data signal from either the Internet, Intranet, or the PSTN to one of the VCs, e.g., VC3)*;*

processing the second unicast signal using a third code to generate a third CDMA signal (see at least FIG. 1, processing of the above signal inside VC3 see also background information on CDMA at 8:66 – 9:45)*;*

transmitting the third CDMA signal(see at least FIG. 1, B Station transmitting that signal to VC3 on the Mobile Station Y)*; and*

in the second subscriber unit (see at least FIG. 1, Mobile Station Y)*:*

receiving the third CDMA signal (see at least FIG. 1, receiving the above signal onto VC3)*;*

demodulating the third CDMA signal into a fourth local demodulated signal (see at least FIG. 1, processing the above signal by VC3 of the Mobile Station Y)*; and*

multiplexing the fourth local demodulated signal onto the second local network for delivery to a fourth destination device (see at least FIG. 1, Multiplexing the demodulated signal and transmitting the multiplexed signal to the "Subscribers").

Claims 46 and 38

Agrawal further discloses *wherein the multicast signal comprises video* (see at least 7:56 - 8:7; the claimed *multicast* signal being equated with video message).

Claims 47 and 39

Agrawal further discloses *wherein the first unicast signal comprises data* (see at least 7:56 - 8:7; the claimed *unicast* signal being equated with data message).

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to Applicant's disclosure.

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hoang-Vu "Antony" Nguyen-Ba whose telephone number is (571) 272-3701. The examiner can normally be reached on Tuesday-Friday from 7:05 am to 5:35 pm.

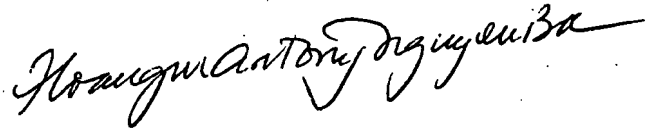
If attempts to reach the examiner are unsuccessful, the examiner's supervisor, John Miller can be reached at (571) 272-7353.

The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Any inquiry of a general nature or relating to the status of this application should be directed to the TC 2600 Group receptionist (571) 272-2600.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov.

Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at (866) 217-9197 (toll-free).



ANTONY NGUYEN-BA
PRIMARY EXAMINER
TECHNOLOGY CENTER 2100

March 16, 2007

UNITED STATES PATENT AND TRADEMARK OFFICE

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Bib Data Sheet

CONFIRMATION NO. 8958

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/020,030	10/30/2001 RULE	725	2623	1483

APPLICANTS
Steven Duane Myers, Lee's Summit, MO;

** CONTINUING DATA ********** Non Han

** FOREIGN APPLICATIONS ********** Non Han

IF REQUIRED, FOREIGN FILING LICENSE GRANTED
** 01/11/2002

Foreign Priority claimed	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ yes ☑ no 35 USC 119 (a-d) conditions met ☐ yes ☑ no ☐ Met after Allowance Verified and Acknowledged Examiner's Signature Initials	MO	7	31 16 Han	4 2 Han

ADDRESS
21396

TITLE
Multi-point multi-channel data distribution system

FILING FEE RECEIVED	
1778	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:

- ☐ All Fees
- ☐ 1.16 Fees (Filing)
- ☐ 1.17 Fees (Processing Ext. of time)
- ☐ 1.18 Fees (Issue)
- ☐ Other _____
- ☐ Credit

REMARKS

Claims 1-31 are pending in the application. Claims 1-31 stand rejected. Claims 1 – 31 are herein cancelled without prejudice. New claims 32 – 47 are added. The applicant respectfully requests consideration of the following remarks and allowance of the claims.

Informalities

The applicant notes that the informality objected to in claim 1 in the office action is obviated in view of the cancellation of the original claims

35 U.S.C. 103(e) Rejections

Claims 1 – 31 are cancelled without prejudice and new claims 32 – 47 are added. The applicant asserts that new claims 32 – 47 are patentable over the art of record and respectfully requests their allowance.

The applicant notes that the office action cites various combinations of 11 prior art references in rejecting the original claims. Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so. The teaching, suggestion, or motivation must be found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. The level of skill in the art cannot be relied upon to provide the suggestion to combine references. (MPEP 2143.01). The teaching or suggestion to make the claimed combination must be found in the prior art and can not be based on the applicant's disclosure. (MPEP 706.02(j)).

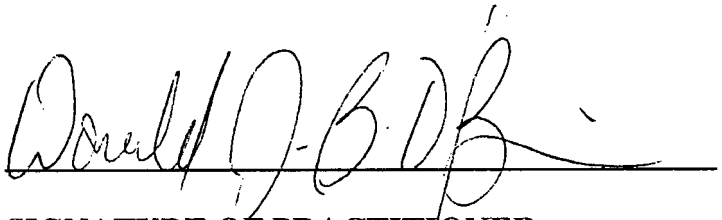
The applicant respectfully requests that if the examiner is to cite such a large number of references, that the office action provide the motivation for combining the references with more particularity.

CONCLUSION

The claims in their present form are allowable over the art of record. Applicant therefore solicits their allowance.

The Applicant believes no additional fees are due with respect to this filing. However, should the Office determine additional fees are necessary, the Office is hereby authorized to charge Deposit Account No. 210765.

Respectfully submitted,



SIGNATURE OF PRACTITIONER
Donald J. Budig-O'Brien, Reg. No. 59,016
Setter Roche LLP
Telephone: (720) 562-2280

Correspondence address:

CUSTOMER NO. 28004
Attn: Melissa A. Jobe
Sprint Law Department
6450 Sprint Parkway
Mailstop: KSOPHN0312-3A461
Overland Park, KS 66251

32. (New) A wireless communication system comprising:

a network transceiver configured to:

receive a first unicast signal;

receive a multicast signal;

process the first unicast signal using a first code to generate a first code division multiple access (CDMA) signal;

process the multicast signal using a second code to generate a second CDMA signal; and

simultaneously transmit the first CDMA signal and the second CDMA signal; and

a first subscriber unit configured to receive the first CDMA signal and the second CDMA signal.

33. (New) The wireless communication system of claim 32 further comprising:

a second subscriber unit configured to receive the second CDMA signal. multicast

34. (New) The wireless communication system of claim 33 wherein the first subscriber unit is configured to demodulate the first CDMA signal into a first local demodulated signal and multiplex the first local demodulated signal onto a first local network for delivery to a first destination device.

35. (New) The wireless communication system of claim 34 wherein the first subscriber unit is configured to demodulate the second CDMA signal into a second local demodulated signal and multiplex the second local demodulated signal onto the first local network for delivery to a second destination device.

36. (New) The wireless communication system of claim 35 wherein the second multicast subscriber unit is configured to demodulate the second CDMA signal into a third local demodulated signal and multiplex the third local demodulated signal onto a second local network for delivery to a third destination device.

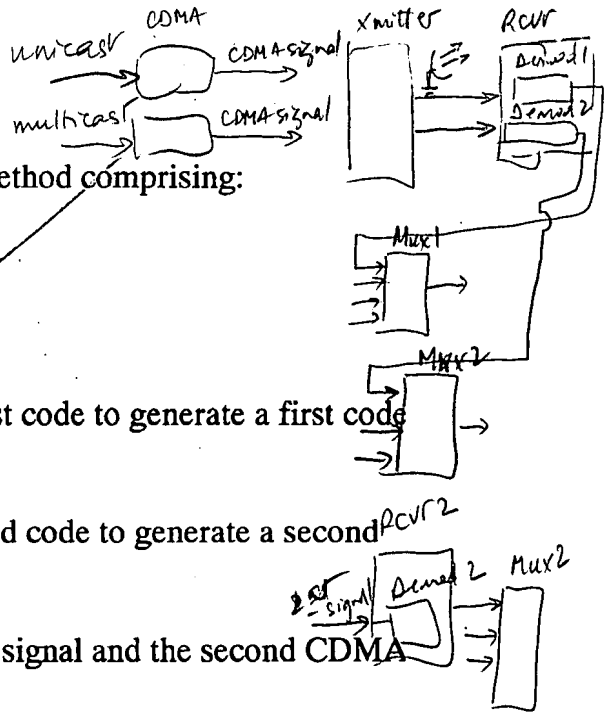
37. (New) The wireless communication system of claim 36 wherein:

the network transceiver is further configured to receive a second unicast signal, process the second unicast signal using a third code to generate a third CDMA signal, and transmit the third CDMA signal; and

the second subscriber unit is configured to receive the third CDMA signal, demodulate the third CDMA signal into a fourth local demodulated signal and multiplex the fourth local demodulated signal onto the second local network for delivery to a fourth destination device.

38. (New) The wireless communication system of claim 32 wherein the multicast signal comprises video.

39. (New) The wireless communication system of claim 38 wherein the first unicast signal comprises data.



40. (New) A method of wireless communication, the method comprising:

in a network transceiver:

receiving a first unicast signal;

receiving a multicast signal;

processing the first unicast signal using a first code to generate a first code division multiple access (CDMA) signal;

processing the multicast signal using a second code to generate a second CDMA signal;

simultaneously transmitting the first CDMA signal and the second CDMA signal; and

in a first subscriber unit:

receiving the first CDMA signal and the second CDMA signal.

41. (New) The method of claim 40 further comprising:

receiving the second CDMA signal in a second subscriber unit.

42. (New) The method of claim 41 further comprising:

in the first subscriber unit:

demodulating the first CDMA signal into a first local demodulated signal; and

multiplexing the first local demodulated signal onto a first local network for delivery to a first destination device.

43. (New) The method of claim 42 further comprising:

in the first subscriber unit:

demodulating the second CDMA signal into a second local demodulated signal; and

multiplexing the second local demodulated signal onto the first local network for delivery to a second destination device.

44. (New) The method of claim 43 further comprising:

in the second subscriber unit:

demodulating the second CDMA signal into a third local demodulated signal; and

multiplexing the third local demodulated signal onto a second local network for delivery to a third destination device.

45. (New) The method of claim 44 further comprising:

in the network transceiver:

receiving a second unicast signal;

processing the second unicast signal using a third code to generate a third CDMA signal;

transmitting the third CDMA signal; and

in the second subscriber unit:

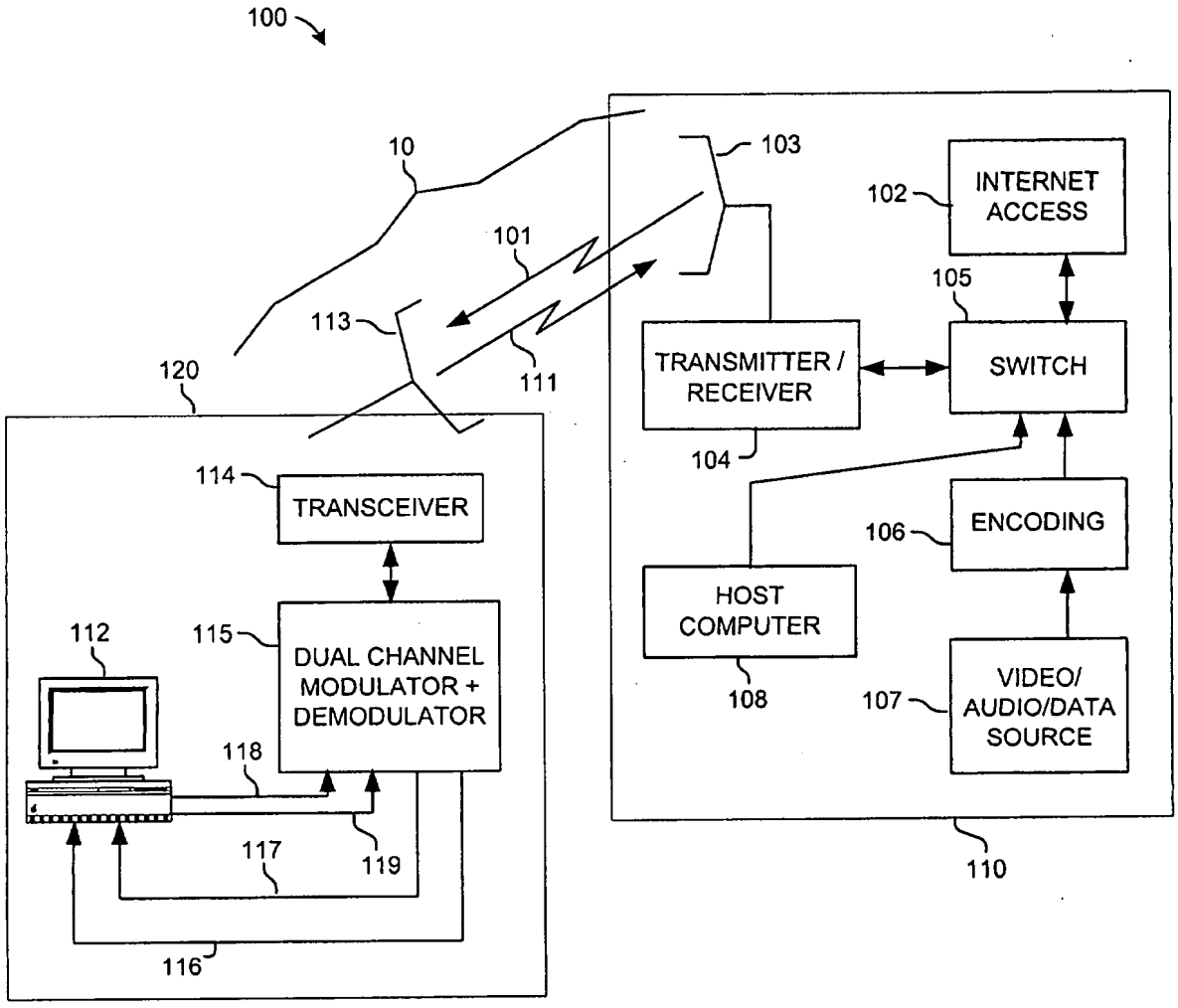
receiving the third CDMA signal;

demodulating the third CDMA signal into a fourth local demodulated signal; and

multiplexing the fourth local demodulated signal onto the second local network for delivery to a fourth destination device.

46. (New) The method of claim 40 wherein the multicast signal comprises video.

47. (New) The method of claim 46 wherein the first unicast signal comprises data.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10
103
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TRANSMITTER / RECEIVER
SWITCH
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TRANSCEIVER
ENCODING
106
112
115
DUAL CHANNEL MODULATOR + DEMODULATOR
HOST COMPUTER
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108
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VIDEO/ AUDIO/DATA SOURCE
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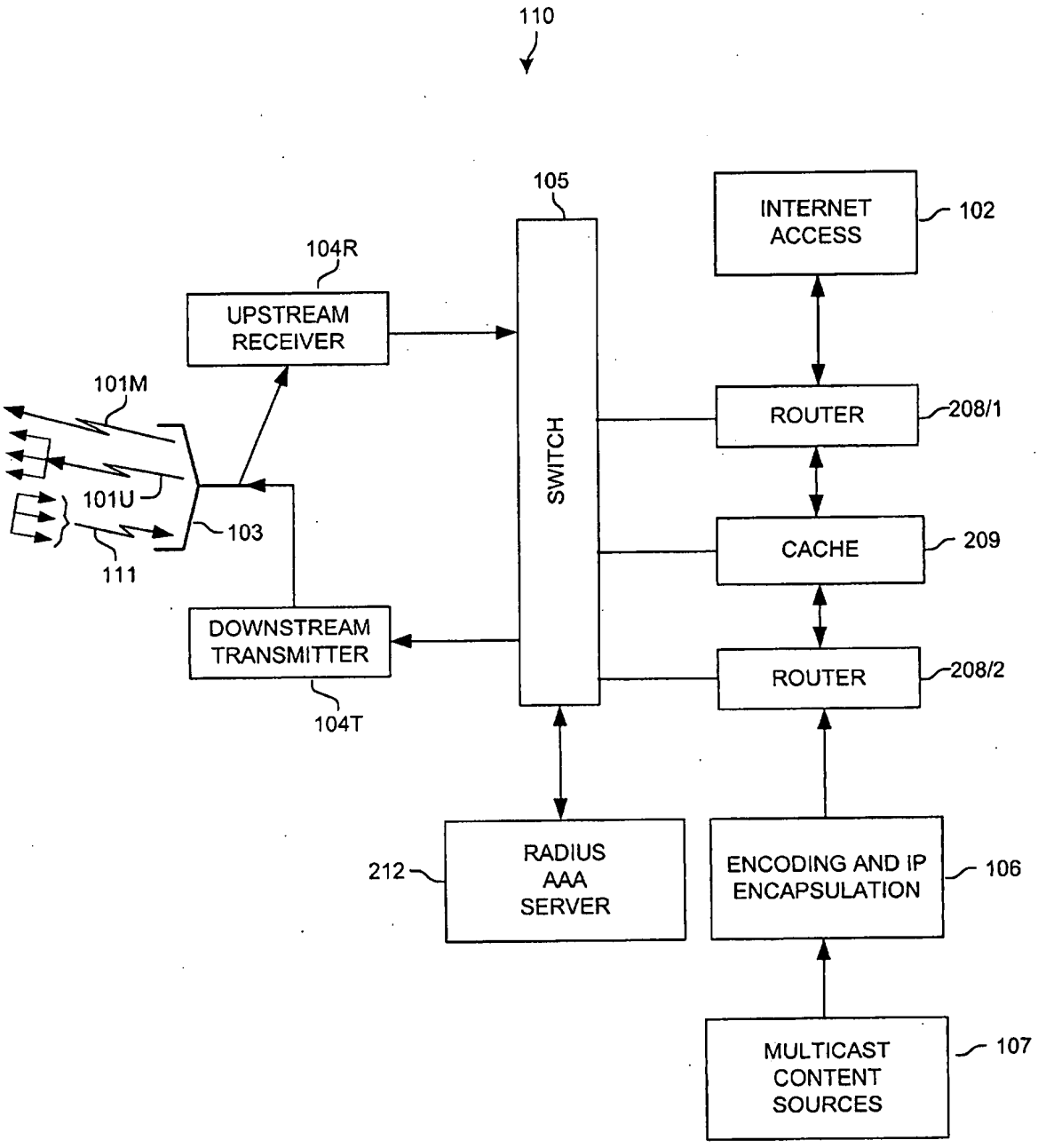
116

FIG. 1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SWITCH
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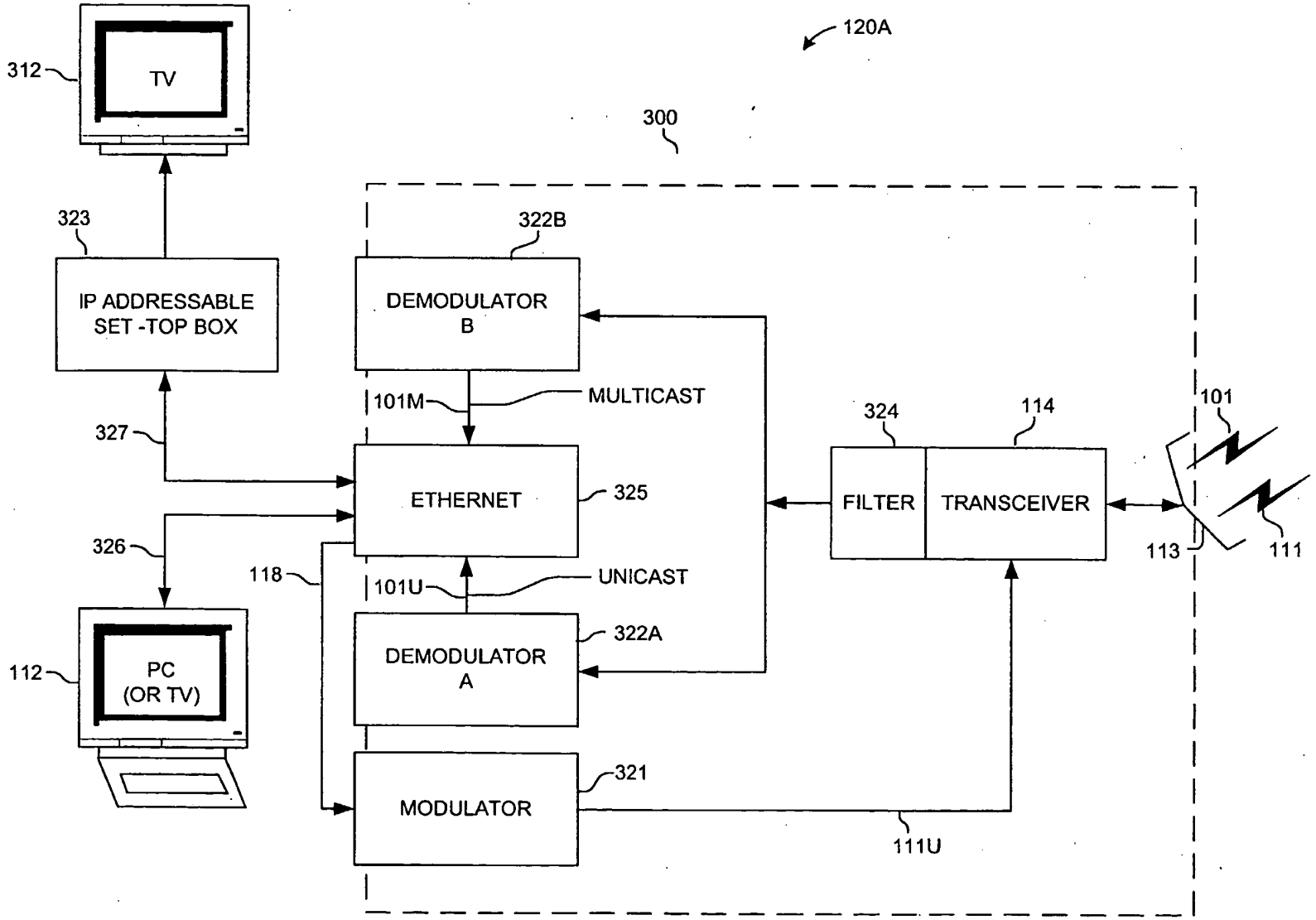
101U
103
CACHE
209
111
DOWNSTREAM TRANSMITTER
ROUTER
208/2
104T
212
RADIUS AAA SERVER
ENCODING AND IP ENCAPSULATION
106
MULTICAST CONTENT SOURCES
107

FIG. 2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322B
DEMODULATOR B
101M
MULTICAST
327
ETHERNET
325
324
FILTER
114
TRANSCEIVER
101
113
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PC (OR TV)
DEMODULATOR A
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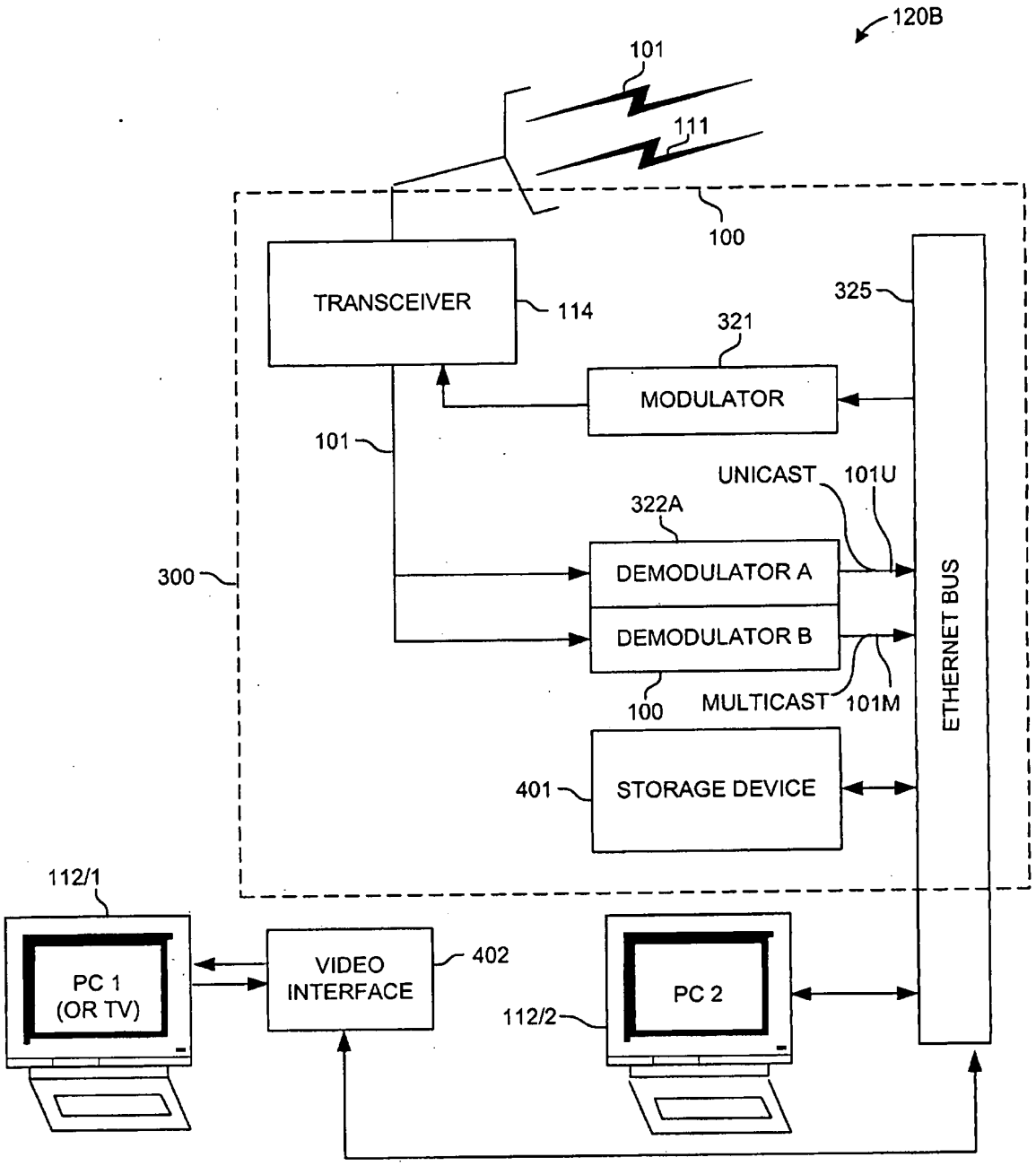
MODULATOR
321
111U

FIG. 3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MODULATOR
101
UNICAST
101U
322A
300
DEMODULATOR A
DEMODULATOR B
100
MULTICAST
101M
ETHERNET BUS
401
STORAGE DEVICE
112/1
PC 1
(OR TV)
VIDEO
INTERFACE
402
112/2
PC 2

FIG. 4

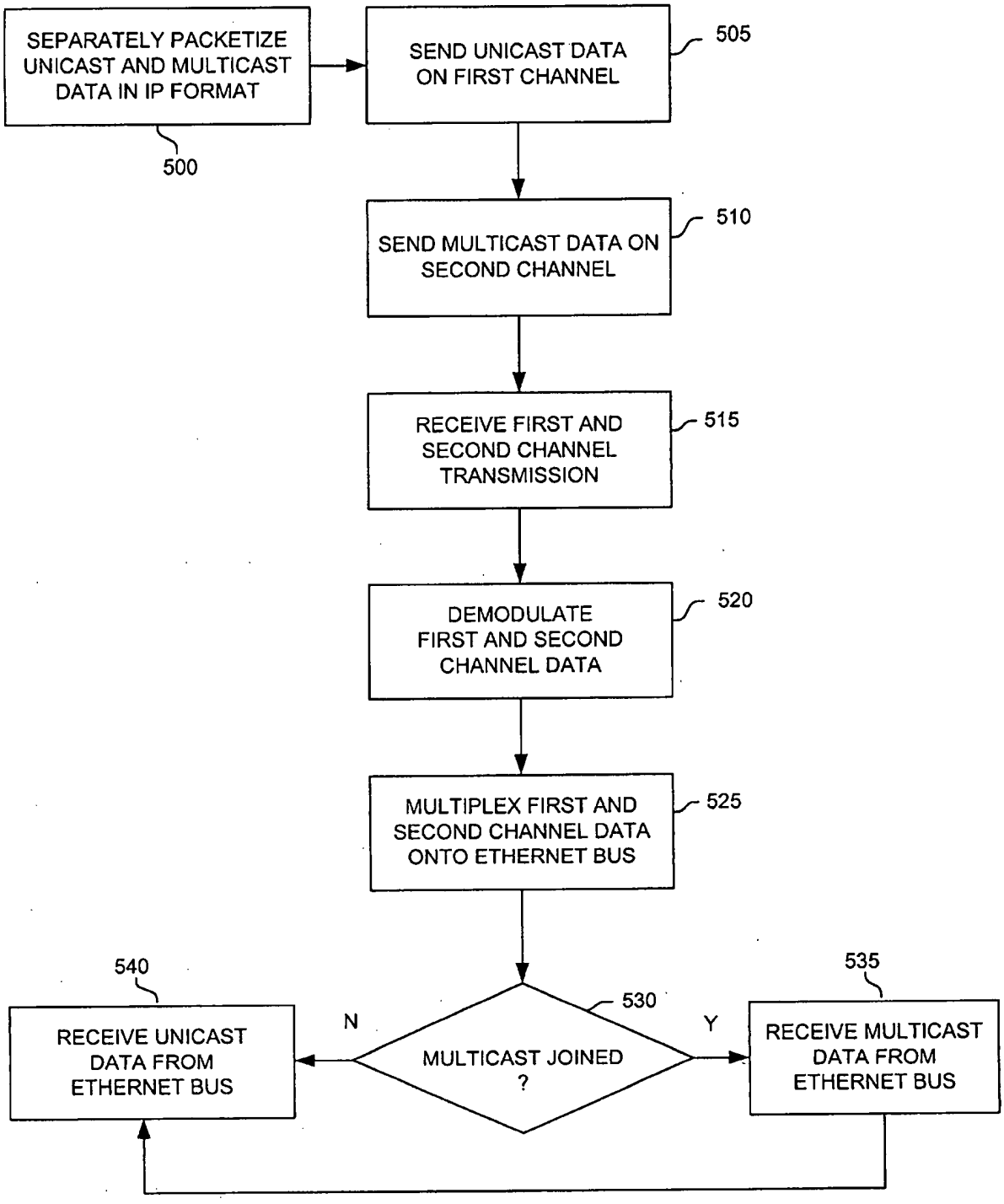
SEPARATELY PACKETIZE UNICAST AND MULTICAST DATA IN IP FORMAT
500
SEND UNICAST DATA ON FIRST CHANNEL
505
SEND MULTICAST DATA ON SECOND CHANNEL
510
RECEIVE FIRST AND SECOND CHANNEL TRANSMISSION
515
DEMODULATE FIRST AND SECOND CHANNEL DATA
520
MULTIPLEX FIRST AND SECOND CHANNEL DATA ONTO ETHERNET BUS
525
MULTICAST JOINED ?
530
N
Y
RECEIVE UNICAST DATA FROM ETHERNET BUS
540
RECEIVE MULTICAST DATA FROM ETHERNET BUS
535

FIG. 5

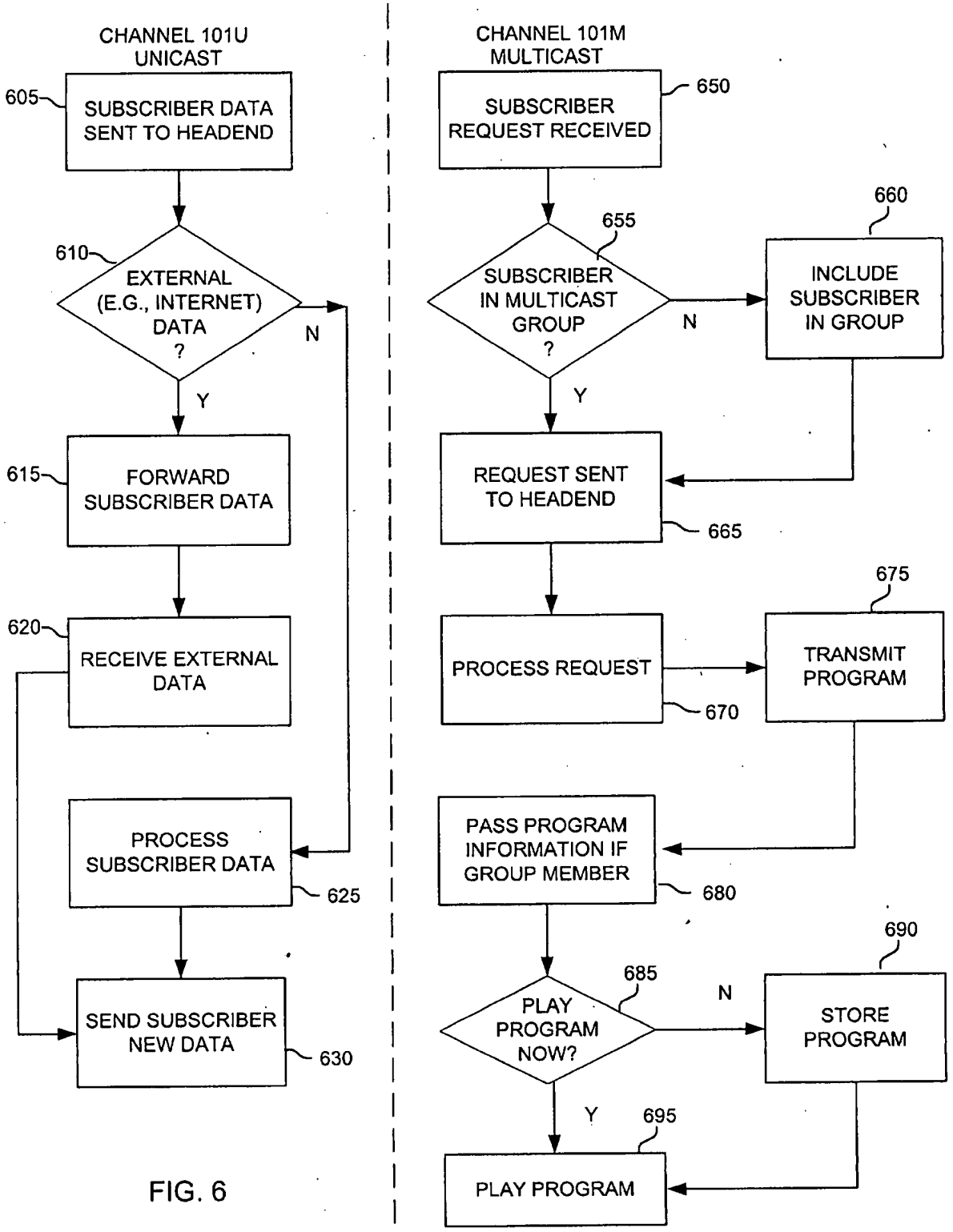
CHANNEL 101U
UNICAST
605
SUBSCRIBER DATA SENT TO HEADEND
610
EXTERNAL (E.G., INTERNET) DATA ?
N
Y
615
FORWARD SUBSCRIBER DATA
620
RECEIVE EXTERNAL DATA
PROCESS SUBSCRIBER DATA
625
SEND SUBSCRIBER NEW DATA
630
CHANNEL 101M
MULTICAST
650
SUBSCRIBER REQUEST RECEIVED
655
SUBSCRIBER IN MULTICAST GROUP ?
N
660
INCLUDE SUBSCRIBER IN GROUP
Y
REQUEST SENT TO HEADEND
665
675
PROCESS REQUEST
TRANSMIT PROGRAM
670
PASS PROGRAM INFORMATION IF GROUP MEMBER
680
690
685
PLAY PROGRAM NOW?
N
STORE PROGRAM
Y
695
PLAY PROGRAM

FIG. 6

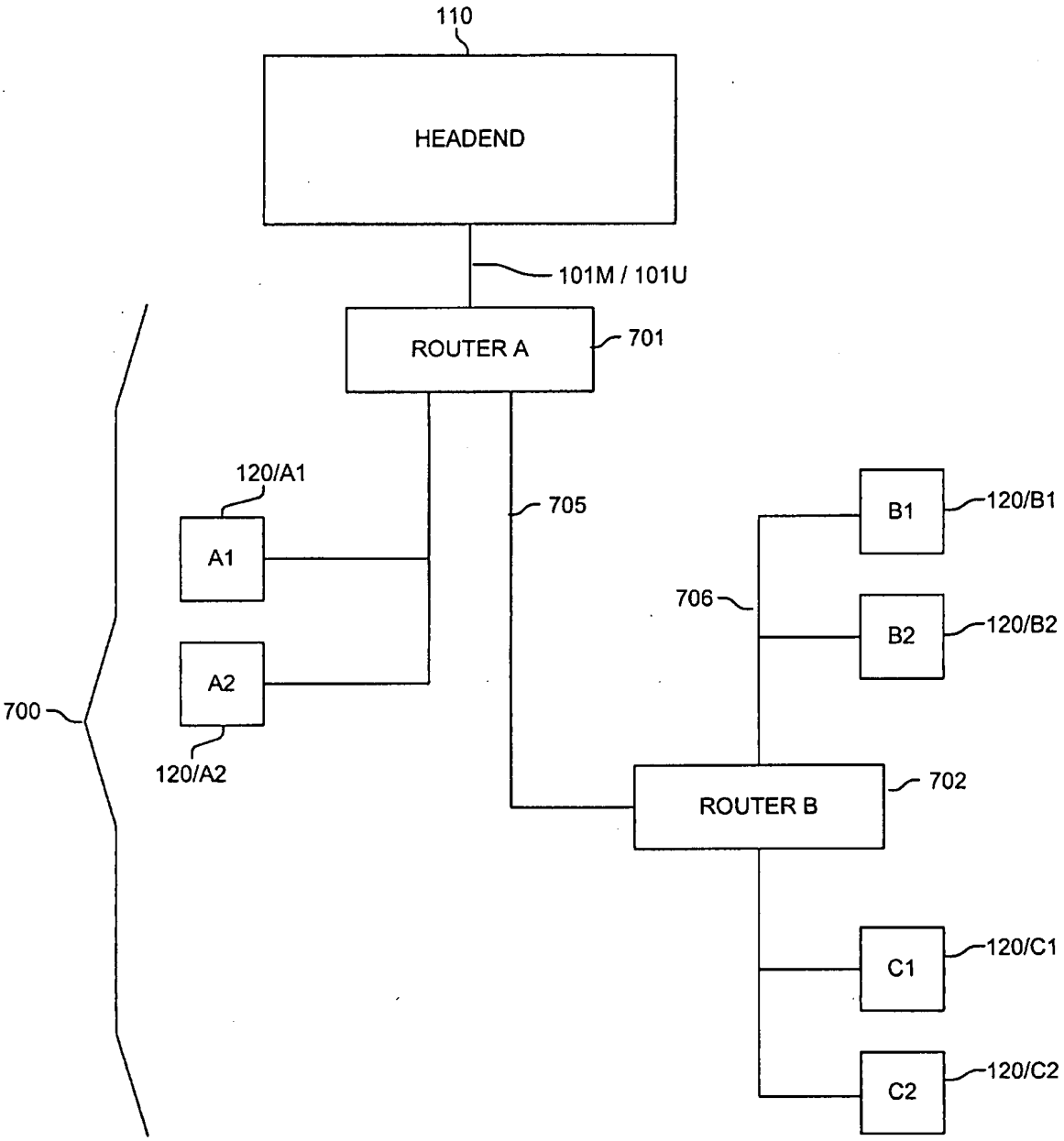
110
HEADEND
101M / 101U
ROUTER A
701
120/A1
A1
A2
120/A2
700
705
B1
120/B1
706
B2
120/B2
ROUTER B
702
C1
120/C1
C2
120/C2

FIG. 7

MULTI-POINT MULTI-CHANNEL DATA DISTRIBUTION SYSTEM

RELATED APPLICATIONS

Not Applicable

FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not Applicable

MICROFICHE APPENDIX

Not Applicable

FIELD OF THE INVENTION

The present invention relates generally to telecommunications systems, and more particularly to a system for providing direct transmission of multiple encoded video, audio, and other data streams to a plurality of subscribers over a shared media.

BACKGROUND OF THE INVENTION

It is presently a problem to efficiently deliver live and/or stored video and other data streams of common interest to multiple subscribers without degrading normal data delivery services. In existing multipoint data distribution systems, use of available bandwidth is not optimal because data is redundantly transmitted. For example, in a present broadband data system, duplicate video streams are sent with each request for viewing through a process known as unicast. In order to deliver a message to n destinations via a unicast transmission, n transmissions of the same message are transmitted.

Furthermore, shared media multipoint data distribution systems such as cable and broadband wireless are bandwidth limited on a per channel

basis. Therefore, bandwidth is wasted anytime more than one user requests the same video/audio/data stream. This in turn reduces the overall bandwidth available to other users sharing the same channel for their individual interests.

SUMMARY OF THE INVENTION

The present invention overcomes the aforementioned problems of the prior art and achieves an advance in the field by providing a system for the efficient distribution of live and stored audio/video streams to multiple subscribers without degrading normal data delivery services. The present system segments one or more frequency bands into sub-bands, or channels, each of which is capable of carrying encoded audio, video, and other data streams, to a plurality of subscribers. Each channel transmitted in the present system provides full-duplex operation so that each subscriber may indicate what specific services are desired, such as audio/video broadcast, two-way data transfer, video library access, pay-per-view video, interactive video, and audio file transfer.

In operation, a transmission headend facility ('hub') broadcasts multiple channels of video/audio data (e.g., Internet data) in unicast mode via a shared media transmission facility (wireless, cable, etc.) to multiple subscribers. Simultaneously, selected video/audio/data (e.g., pay-per view) is transmitted in IP (Internet Protocol) multicast mode over one or more channels of the segmented frequency band. The subscriber is provided a device (a 'subscriber unit') which simultaneously and dynamically demodulates 2 or more channels (on different frequencies) and interleaves the information over a single ethernet interface connected to one or more IP enabled devices. Each subscriber thus has

the capability of, for example, receiving a video stream concurrent with many other subscribers while simultaneously interacting uniquely with the Internet or other data network. A number of subscribers may thus simultaneously share the same interactive channel without performance degradation, up to the limit of the subscriber network. In an alternate embodiment of the present system, an IP enabled television set or subscriber unit (e.g., a set top box, etc.) at multiple subscribers' premises may receive a digitally encoded video on the multicast channel at the same time multiple subscriber's computers are sending or receiving data via shared unicast channels.

In one optional aspect of the present system, the headend schedules a wide variety of data services which include full-duplex or asymmetrical transmission of interactive, on-demand, pay-per-view video services, audio file transfer, etc. In response to receiving a subscriber request for a particular service, the subscriber unit allows the multicast transmission to pass through to the subscriber's local network. Otherwise the multicast transmission channel(s) are ignored by the subscriber unit. For real-time broadcasts, the headend authorizes access to the requested broadcast stream(s) using a subscriber's permissions profile.

The present system uses IP multicasting and video compression technology to simultaneously deliver from approximately 7 to 100 video streams at data rates of approximately 300Kbps to 4Mbps, thereby optimizing bandwidth use in a multipoint data distribution system. The customer premises equipment for each subscriber includes two demodulators which convert the two received

channels from RF back to IP-formatted data streams appropriate for the intended receiving devices such as a personal computer ('PC') and/or other IP enabled appliance.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a conceptual diagram of the present system;

Figure 2 is a block diagram illustrating typical components utilized at the headend or hub of the present system;

Figure 3 is a block diagram illustrating exemplary components used for demodulating and distributing a received multi-channel signal at a subscriber site;

Figure 4 is a block diagram illustrating subscriber site components used in an alternative embodiment of the present system;

Figure 5 is a flowchart illustrating basic operation of the present system;

Figure 6 is a flowchart illustrating an exemplary sequence of steps performed by the present system in asynchronously processing subscriber requests for audio, video, or other information via a unicast channel and a multicast channel; and

Figure 7 is a network diagram, illustrating multicast operation of the present system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 is a conceptual diagram of the present system 100, which delivers multicast and unicast information to a plurality of subscribers in a bandwidth efficient manner. In an exemplary embodiment, the present system segments one or more frequency bands into sub-bands, or channels, each of which is capable of carrying encoded audio, video, and other data streams, to a plurality of subscribers. Each channel transmitted in the present system provides full-duplex operation so that each subscriber may indicate what specific services are desired, such as audio/video broadcast, two-way data transfer, video library access, pay-per-view video, interactive video, and audio file transfer.

An exemplary embodiment of the present system uses multicasting and video compression technology to simultaneously deliver from 7 to 100 video streams at data rates of 300Kbps to 4Mbps, thereby optimizing bandwidth use in a multipoint data distribution system.

As shown in Figure 1, headend (hub) 110 sends multicast and unicast data 101 to a plurality of subscriber sites 120 (only one of which is shown) via communication link 10 comprising transmitter/receiver 104, antennas 103 and 113, and transceiver 114. Data 111 is transmitted from subscriber site 120 to headend 110 via the same link 10. In operation, the transmission headend facility 110 transmits multiple channels of video, audio, or other data (e.g., Internet data) in unicast mode via a shared media transmission facility (wireless, cable, etc.) to multiple subscribers via a segmented frequency band. Simultaneously, selected video/audio/data (e.g., pay-per view) is transmitted in

multicast mode over one or more channels of the segmented frequency band. The information on each of the channels is formatted in accordance with Internet protocol (IP) for addressing purposes. The use of IP addressing allows the present system to send data over the Internet as well as by RF transmission.

In an exemplary embodiment, the present system 100 delivers two non-multiplexed RF data channels 101 from headend 110 to subscriber site equipment 112–119 that receives and demodulates the two RF channels simultaneously, then multiplexes the two demodulated channels onto a single Ethernet interface. Any IP-addressable device may be connected to the Ethernet interface to receive one or both of the signals. The present system thus efficiently delivers multicast data of common interest to a plurality of recipients while not significantly impacting the performance of delivery of data to individual unicast data recipients.

In an alternative embodiment, the present system 100 transmits a signal using a coded modulation technique such as code-division multiple access (CDMA) or synchronous code-division multiple access (S-CDMA, a proprietary version of CDMA). Coded modulation is a technique whereby forward error correcting (FEC) coding techniques are integrated with the channel modulation, allowing schemes to be devised which are both bandwidth and power efficient. CDMA is a coding scheme, used as a modulation technique, in which multiple channels are independently coded for transmission over a single wideband channel. CDMA is a spread-spectrum approach to user multiplexing. Users in a CDMA environment simultaneously share the same radio frequency band and

can be separated at the receiver end with the knowledge of their unique code. Other modulation methods, including digital modulation techniques such as orthogonal frequency-division multiplexing (OFDM) may also be employed for simultaneous delivery of unicast and multicast data in accordance with the present system.

Headend 110 includes a switch 105 for controlling data flow between subscriber sites 120 and information sources such as the Internet (via Internet access or other data source 102) and other video/audio/data sources 107. Information (from sources 107) that does not originate on the Internet is formatted with appropriate IP addressing information and packetized by encoding equipment 106.

In the exemplary embodiment shown in Figure 1, each subscriber site 120 includes a dual channel modulator/single channel demodulator 115 for converting the two data channels from RF to digital signals. Downstream data 101 from headend 110 is sent to subscriber site 120 via link 10 and demodulated into a unicast component signal 117 and a second component signal 116, both of which are in an IP format. The second component signal is typically a multicast signal, but this signal can be a broadcast, or other type of signal of common interest to more than 1 recipient. Subscriber data receiving device 112, which can be a standard personal computer (PC) or a television set with an IP-enabled set-top box, receives transmissions having a subscriber site's specific IP address(es). In the case where a single device, such as a PC, simultaneously receives both unicast and multicast channels, the device requires two network

interface cards ('NIC's or other means for uniquely identifying a particular device on a network), each set to a different IP address. Subscriber data receiving device 112 may send IP-formatted data signals 118 and 119 (shown collectively as signal 111) upstream via link 10 to headend 110. Upstream signals 118 and 119 are return channels typically corresponding to the received multicast signal 116 and unicast signal 117, respectively.

Figure 2 is a block diagram illustrating typical components utilized at the headend of the present system 100. As shown in Figure 2, multicast content such as pay television or video-on-demand data originating from non IP-formatted sources 107 is encoded (formatted) and encapsulated (packetized) by equipment 106 that is well-known in the art. Routers 208/1 and 208/2, and cache memory 209 are employed to direct and temporarily store data being transferred between data sources 102/107 and switch 105. Host computer 108 may be used to control and monitor various aspects of system operation including setting up membership in multicast groups, as explained below with respect to Figure 7.

In an exemplary embodiment of the present system, downstream transmitter 104T sends a plurality of unicast signals on channels 101U and a single multicast channel 101M to a plurality of subscriber sites 120 via antenna 103. In an alternative embodiment of the present system, antenna 103 is replaced by an Internet link or other network, as described below with respect to Figure 7.

A plurality of channels of IP-formatted data 111 from various subscriber sites 120 are received by upstream receiver 104R. Return channel server 212 is used for processing upstream data from subscriber sites 120, for

example, to determine subscriber identities and for scheduling subscriber-requested programming.

In one optional aspect of the present system, headend 110 schedules a wide variety of data services which include full-duplex or asymmetrical transmission of interactive, on-demand, pay-per-view video services or other programming content, audio file transfer, etc. In response to receiving a subscriber request for a particular service, a subscriber unit 300 (described below with respect to Figure 3) allows the multicast transmission to pass through to the subscriber's local network. Otherwise, the multicast transmission channel(s) are ignored by the subscriber unit. For real-time broadcasts, the headend authorizes access to the requested broadcast stream(s) using a subscriber's permissions profile by initiating a join request which is subsequently authenticated and authorized by server 212 using standard AAA (authentication, authorization, accounting) mechanisms such as RADIUS.

Figure 3 is a block diagram illustrating components used for demodulating and distributing a received multi-channel signal at a subscriber site 120A in an exemplary embodiment of the present system. In the embodiment shown in Figure 3, each subscriber site 120A is provided with a device (a 'subscriber unit') 300 which receives RF signals 101M and 101U on different frequencies. The exemplary embodiment of Figure 3 includes a television set 312 and a PC 112 connected to subscriber unit 300 via an Ethernet link 325/326/327. Note that any IP-addressable device may be used in lieu of TV 312 or PC 112. In operation, transceiver 114 receives signal 101 comprising a

plurality of unicast channels 101U and a multicast channel 101M. The received signals are simultaneously and dynamically demodulated and interleaved over a single local network interface 325 connected to one or more IP enabled devices 112/312.

Subscriber unit 300 is programmed as to which two downstream channels 101M/101U it will be demodulating. The two signals are selected by transceiver 114 which also controls when it will pass the information on through to the local network 325/326/327. Subscriber unit 300 multiplexes the received data from both downstream channels onto the local subscriber network. Local network 325/326/327 typically employs an Ethernet bus, but the network could, alternatively, be any type of local network, including wireless LANs such as those conforming to the IEEE draft standard 802.11.

The plurality of unicast signals on channels 101U may, optionally, be filtered by a programmable filter 324 in transceiver 114, so that the only unicast channel sent to ethernet link 325 is the channel containing the unicast information intended for the specific subscriber site 120A. A mechanism such as a digital filter (having an encoded subscriber ID, or using a subscriber IP address) may be provided for ensuring that a given subscriber does not have access to other subscriber's unicast channels.

Although, in the embodiment of Figure 3, the plurality of unicast channels 101U are transmitted to all subscribers, a given subscriber PC or TV receives only the unicast subchannel intended for that specific subscriber, as filtered by transceiver filter 324, if present, and which has an IP address that

matches the IP address of the subscriber site equipment. Each subscriber site has a unique identifier included in the IP address that is encoded in each transmission from headend 110. PC (or TV) 112 and set-top box 323 thus receive only the signal having the IP destination address that matches the IP address used by the IP-addressable set-top box 323 or the subscriber's network interface card ('NIC', not shown) in PC 112.

Transceiver 114 also receives multicast transmissions on an RF channel that is separate from the unicast transmissions. In order to receive a particular multicast transmission, an IP-addressable recipient (PC 112 or set-top box 323) at the subscriber site 120A sets its IP process and network interface card (NIC) to receive the multicast on a specific group's address and port, as explained below in detail. PC 112 and/or set-top box 323 receive only multicast transmissions having an IP address that PC 112 and/or set-top box 323 have designated as being of interest.

After being received by transceiver 114, signal 101, containing the unicast signal 101U and the multicast signal 101M, is sent to demodulators 322A and 322B, which demodulate the received signal into unicast signal 101U and multicast signal 101M, and multiplex the digital signals onto the Ethernet link 325. Demodulators 322A and 322B may be a single device, i.e., a dual channel demodulator. Ethernet link 325 is then used to deliver the digital signals 101U and 101M to PC 112 and set-top box 323, respectively, via Ethernet connections 326 and 327. Modulator 321 is used for modulation of signals (e.g., Internet

upstream transmissions or on-demand requests) sent from PC 112 upstream to headend 110 via channel 111U.

The above-described system allows each subscriber to have the capability of, for example, receiving a video stream concurrent with many other subscribers while simultaneously interacting uniquely with the Internet or other data network. A number of subscribers may therefore simultaneously share the same interactive transmission medium with the ability to opt-in to a second service simultaneous with a primary service without interruption or degradation of the primary service.

Figure 4 is a block diagram illustrating subscriber site components used in distributing a received multi-channel signal at a subscriber site 120B in an alternative embodiment of the present system. As shown in Figure 4, two PCs 112/1 and 112/2 are coupled to subscriber unit 300. Alternatively, device 112/1 can be a television set, in which case video interface is the same as set-top box 323 shown in Figure 3. Subscriber unit 300 comprises transceiver 114, modulator 321, demodulators 322A and 322B, storage device 401, and Ethernet bus 325. In the exemplary embodiment of Figure 4, PC1 (or TV) 112/1 and PC2 112/2 are connected to the components in subscriber unit 300 via Ethernet bus 325.

In operation, transceiver 114 receives signal 101 comprising a unicast channel 101U and a multicast channel 101M. These signals are demodulated and placed on Ethernet bus 325, as explained above with respect to Figure 3. When device 112/1 is a PC, a video interface card 402 converts

received digital television signal into a signal appropriate for displaying video images on the device's video monitor.

Storage device 401 is a disk drive, rewriteable DVD (digital Video disk), or the like, for storing video and audio information. Storage device 401 may be employed to effect time-shifting of programming by storing a received program and playing back the stored program at a later time.

Figure 5 is a flowchart illustrating basic operation of the present system. As shown in Figure 5, at step 500, unicast and multicast data are separately packetized and encoded in IP format by encoding equipment 106 at headend 110. At step 505, unicast data, such as an Internet transmission, is sent from the headend via one of the plurality of channels 101U. Multicast data is sent from headend 110 via channel 101M, at step 510, which occurs simultaneously with the transmission of unicast data. Next, both unicast and multicast channels are received at each of the subscriber sites 120/120A/120B (hereinafter generically referred to by reference number 120*), at step 515. As explained above with respect to Figures 3 and 4, at step 520, the data on channels 101U and 101 M is then demodulated at the subscriber sites, and at step 525, the demodulated data is multiplexed onto an Ethernet bus.

At step 530, if a particular subscriber site has 'joined' the multicast transmission (as explained below with respect to Figure 7), then at step 535, the multicast data is received by the appropriate subscriber site PC/TV. At step 540, unicast data is received by the PC or set-top box having the IP address encoded in channel 101U.

Figure 6 is a flowchart illustrating an exemplary sequence of steps performed by the present system in asynchronously processing subscriber requests for audio, video, or other information via a unicast channel and a multicast channel. The blocks to the left of the vertical dotted line in Figure 6 illustrate steps preformed with respect to the transmission of unicast data, and the blocks to the right of the dotted line illustrate the transmission of multicast data. Note that the data on the unicast channel is not interleaved with the data on the multicast channel at the RF level. The content or data contained on both channels is interleaved at the local network level by subscriber unit 300, as described above.

As shown in Figure 6, at step 605, data is received at headend 110 from a subscriber site 120*, via one of the upstream channels 111. At step 610, if the received subscriber data is 'external' data, such as Internet data (i.e., data not intended for processing by the headend facility), then at step 615 the data is forwarded to the appropriate destination. Otherwise, the received subscriber data is processed by return channel server 212, at step 625. If a particular subscriber is transmitting and receiving external data, e.g., via the Internet, then data (if any) is received from Internet access or other external data source 102, at step 620. At step 630, new data, either from external source 102 or from return channel server 212, is sent to the subscriber site via the appropriate unicast channel 101U.

Multicast data is transmitted from headend 110 simultaneously and asynchronously relative to the transmission of unicast data. Detailed aspects of multicast operation are described below with respect to Figure 7. As shown in

Figure 6, at step 650, a subscriber request for audio, video, or other programming is received via channel 111 by return channel server 212. At step 655, if the subscriber of interest has not already joined a multicast group, then at step 660, the subscriber is included in the appropriate group, and at step 665, the subscriber request for programming is sent via channel 111 to headend 110. At step 670, the subscriber request is then received and processed by return channel server 212. When the requested program is available, at step 675, the program information is transmitted via channel 101M to a plurality of subscriber sites 120. At step 680, each subscriber site that has joined the present multicast group allows the multicast program to be passed through the appropriate PC 112* or set-top box 323. Because the subscriber unit 300 and/or client software in a PC 112 is multicast enabled, the subscriber either receives or ignores the multicast data. Even if the data on channel 101M is not a standards-based multicast, (e.g., if a proprietary transmission protocol and client software are employed) the above-described process still applies. It also allows unicast data to flow simultaneously on the same ethernet link.

At step 685, if the subscriber site has scheduled the program for the present time, then the program is 'played' (e.g., viewed, if the program is a movie), at step 695. If the subscriber site has scheduled the program for a later time, then at step 695, the program is stored on storage device 401 for subsequent playback.

Figure 7 is a network diagram, illustrating multicast operation of the present system in an alternative embodiment. In the system shown in Figure

7, an Internet link or other network 700, such as a cable network, replaces antenna 103 and transmitter/receiver 104 shown with respect to the previously described embodiments. Multicasting is essentially the transmission of a message to a group of receivers (comprising a subnet of a network) that are identified and selected via one or more routers or other devices that selectively forward the message. As described in detail below, each of these receivers must indicate whether or not it wants to receive the message. A multicast network forwards multicast data only to network subnets that have at least one receiver that has indicated it wants to receive a particular message. In contrast, broadcasting floods all subnets (i.e., the entire network) with data, thus often resulting in comparatively inefficient use of bandwidth. In the present embodiment, each receiver 120* may be viewed as comprising a subscriber unit 300 and a PC 112* or set-top box 323 and associated client application located at a subscriber site 120. Each receiver shown in Figure 7 is thus, in effect, a subscriber site 120*.

Although signal 101M is transmitted in an IP multicast format in each of the embodiments described herein, the transmission mechanism employed by the system shown in Figures 1–4 is, technically, a broadcast that is selectively ignored by certain subscriber units. The networking embodiment shown in Figure 7 includes sub-networks which allow the system to take advantage of the selective sub-networking that distinguishes multicast over broadcast. In the embodiment of Figure 7, both unicast channels 101U and

multicast channel 101M are directed to the appropriate destination subscriber sites 120* by routers 701 and 702.

In the example shown in Figure 7, either subscriber site B1 or B2 (or both of the sites) has (or have) requested to receive a particular multicast transmission and joined the appropriate multicast group. In this situation, the requested multicast transmission is selectively forwarded via routers 701 and 702 and paths 705 and 706 to both subscriber sites B1 and B2, since both of these sites are on the same subnetwork of router B. Note that network bandwidth is conserved by avoiding transmission of the multicast data to any receivers (sites) other than those that are located on a subnetwork wherein at least one subscriber has indicated that it wants to receive a particular multicast transmission. It should also be noted that unicast data is transmitted and received by each intended recipient on network 700 simultaneously along with the selected transmission of multicast data, regardless of the subnetwork on which a particular unicast data recipient is located. For example, unicast data may be transmitted over network 700 simultaneously to subscriber sites A1, B1, and C2 simultaneously with the multicast transmission to sites B1 and B2 in the present example.

As indicated above, subscribers (clients) indicate that they would like to receive a particular transmission by joining a 'multicast group' which has been set up by a host computer 108 connected to switch 105 at the headend 110. In an exemplary embodiment of the present system, the Internet Group Management Protocol (IGMP) is used by IP host 108 to report host group

memberships to any immediately-neighboring multicast routers, which in the present case, is router A (701). Multicast protocols other than IGMP, for example, PIM, PGM, MBGP, IDMR, MSDP, or SSM, may also be used to implement the multicast aspect of the present system. In the present example, multicast routers A and B (701 and 702) send Host Membership Query messages to discover which host groups have members on their attached local networks. A multicast router keeps a list of multicast group memberships for each attached network, and a timer for each membership.

A client (i.e., a software application running on a subscriber's PC 112* or set-top box 323) joins a multicast group by sending an IGMP membership report message. IGMP is common to all multicast router protocols, and isolates end users from the routing protocol in use. When a subscriber enters a request for a specific program (via a PC 112 or a keypad on set-top box 323), the client joins a multicast group by initiating two processes. First, an IGMP message (i.e., a join request) is sent to the client's local router to inform the router that the client wants to receive data sent to the group. In the embodiments shown in Figs 1–4, there are no downstream network routers; therefore, in these embodiments, the IGMP message sent to a 'local router' (e.g., router 208/1) at the headend 110. Next, the subscriber's appropriate PC 112* or set-top box 323 sets its IP process and network interface card (NIC) to receive the multicast on the group's address and port. Multicast addresses are Class D IP addresses ranging from 224.0.0.0 to 239.255.255.255. Class D IP addresses map automatically to IEEE-802 Ethernet multicast addresses, which simplifies the

implementation of IP multicasting on Ethernet. To support the reception of multicast IP datagrams, an Ethernet module receives packets addressed to the Ethernet multicast addresses that correspond to the host's IP host group addresses. The Ethernet module listens on an arbitrary number of Ethernet multicast addresses, which may be accomplished by "opening up" the address filter to accept all multicast packets during those periods when the number of addresses exceeds the limit of the filter.

Before a subscriber (more specifically a client) can join a multicast group, the client needs to determine which group is the one in which the client is presently interested in joining. Assuming that there are a number of choices for programs to be viewed on-demand, two steps must be initially performed:

(1) the subscriber selects the program of choice via a PC 112 or a keypad on set-top box 323; and

(2) the subscriber PC or set-top box client software then correlates the program selected by the subscriber with a specific group ID (previously sent to the subscriber with, for example, a program list).

If the join request is granted, the subscriber client as well as all intermediate routers (if any) in the path between the client and the headend begin passing the requested multicast stream through where it is interleaved with other data from the unicast channel onto the subscriber's ethernet bus 325. If a movie or other programming is already in progress, then the client simply allows those packets to pass (much like tuning a TV to a particular channel).

A request is required to initiate transmission of the movie if no one else on the subscriber's subnetwork has done so. As described above with respect to Figure 6, the program request is sent to the headend 110, where it is processed by return channel server 212. After being transmitted to the appropriate subnetwork(s), the multicast channel is then received, demodulated and multiplexed onto an ethernet connection for receipt by all devices connected to the subscriber's local (e.g., Ethernet) network, as described with respect to Figures 3–5.

When a client/subscriber leaves a group, where the client was the only one receiving the multicast on a particular subnetwork, the local router stops sending data to the client's subnetwork, thereby freeing bandwidth on that portion of the network. The process of leaving a group is not shown on the flowchart in Figure 6, but this can be accomplished either explicitly by the client, or by a local router, via time-out of a timer.

While exemplary embodiments of the present invention have been shown in the drawings and described above, it will be apparent to one skilled in the art that other practicable embodiments of the present invention are possible. For example, the specific configuration of the headend and subscriber sites as well as the various protocols employed and the particular flowchart steps and sequences thereof described above should not be construed as limited to the specific embodiments disclosed herein. Modification may be made to these and other specific elements of the invention without departing from its spirit and scope as expressed in the following claims.